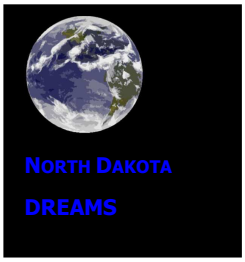
North Dakota

Disease
Reporting
Epidemiological
Assessment and
Monitoring
System

Post Implementation Review



North Dakota Department of Health
Division of Disease Control

September 2005

Table of Contents

BACKGROUND

Over the past 20 years the public health system within the United States has been on the decline. This is remarkable considering that during this time public health systems have had to deal with numerous outbreaks of newly emerging infectious diseases (i.e., SARS, West Nile Virus, Legionnaires), a continual increase in chronic diseases, and HIV which is rapidly becoming one of the most deadly diseases ever to face humankind. In addition to this, public health continues to fail to grow the talent needed to establish and manage disease surveillance systems, conduct thorough epidemiological investigations, manage complex health information systems, and develop, implement, and exercise public health emergency response plans among other tasks. On top of these challenges public health is now faced with the threats of terrorism on a scale never before imagined. This is a significant imbalance and needs correction.

Several strategic initiatives have begun to address these challenges. First, in the late 1990's, the Centers for Disease Control and Prevention (CDC) started an electronic surveillance and reporting focus group. Their intent was to create a system for collecting and reporting data which would operate on the internet backbone. The second initiative was a move by the state of North Dakota to assess current technology in the state and the development of a surveillance system based upon the recommendations of the assessment.

In July of 2001 the state of North Dakota initiated a strategic planning process to address the vision supported through the CDC National Electronic Disease Surveillance System (NEDSS). The resulting strategic plan identified a detailed implementation process to improve public health infrastructure within the state specific to disease reporting. The development of this plan included stakeholders in both the public and private sector as well as the military and Indian Health Services. This plan addressed disease surveillance preparedness, integration with the Health Alert Network, electronic data collection and notifications. It included estimates for new and evolving information systems roles and responsibilities, budgets and timelines. This plan illustrated how these recommendations would support bioterrorism preparedness.

The NEDSS plan allowed North Dakota to document for all stakeholders, as well as for the senior level managers, the need to improve public health in of support disease surveillance. This has further been substantiated through CDC guidance that dictates states address:

- Preparedness planning and readiness assessment
- Surveillance and epidemiologic capacity
- Biological laboratory capacity
- Health Alert Network/communication and information technology
- Risk communication and health information dissemination
- Education and training

As has been noted, each of these areas required projects to provide the following for each of the capacities identified:

- A description of existing capacity
- An assessment to determine whether the capacity is adequate
- Where the capacity is deemed inadequate a proposal or implementation plan must be developed

In addition, there are numerous references related to the need for projects to address the development of planning documents and to exercise these plans to ensure some degree of proficiency in response to bioterrorism and other public health emergencies. Each of these activities must be clearly identified in the project's work plan.

The NEDSS Strategic Plan in North Dakota, which included a full assessment of all systems supporting disease surveillance, provided a head start on defining the problems and identifying solutions. The next step was to implement these solutions, test and monitor their effectiveness, evolve and improve these solutions for disease surveillance to support the larger terrorism initiatives. The preparedness and response effort required expanding the NEDSS plan to include other stakeholders and to further address the needs of the communities in this area. The remainder of this document identifies a set of specific planning and information technology tasks that were proposed for funding under this grant. These task falls into three specific areas:

- Preparedness planning and readiness assessment
- Surveillance and epidemiology capacity
- Health Alert Network/communication and information technology

PLANNING TASKS

During the planning phase, it was necessary to make modifications to the original NEDSS plan. These modifications allowed the project to more thoroughly address public health needs as well as provide opportunities for future uses and enhancements. Changes to the plan that resulted in significant impacts are discussed below.

1. Identification of additional statewide partners whose interests will need to be represented and addressed by the system. Local public health units, private providers and private laboratories are integral to the success of any public health surveillance system. Security roles needed to be added to accommodate these public health partners.
2. The system must be configured such that additional modules may be added without significant restructuring of the system. As new program area modules such as STD and tuberculosis become available or are developed, the modules must be seamlessly added as complements to the base system.
3. Through increasing partnerships with other public health entities, the surveillance and epidemiology capacity will continue to evolve. The system must be flexible enough to accommodate these changes, particularly in outbreak settings.
4. As other public health information technology systems mature, the DREAMS system must be able to communicate with them. Of particular importance is the Health Alert Network (HAN). The alerting capabilities of the HAN greatly supplement those of DREAMS.

IMPLEMENTATION

A multiphase approach was required that allowed for systematic development, implementation and integration. This was an evolving process. The initial objective was to implement sharable tools as well as implement an internet based communicable disease reporting (CDR) system. The CDR is web-based. A backend dataset was created compliant with the CDC Logical Data Model (LDM). It also included internet based data collection and electronic collection of data from the state laboratory. The plan was to implement these in a pilot project and then expand to all state users. As the base system components became available they were integrated into this infrastructure.

Specific Anticipated Benefits

1. The system will provide centralized surveillance information in an electronic format to support disease and bioterrorism preparedness planning and management.

   Measurement: The system must store not just core demographic data electronically, but also extended interview data.

   Goal Attainment: Previous surveillance systems either did not store data electronically or did so only in a limited format. DREAMS has the ability to store all extended disease surveillance forms. This additional data is used to identify disease clusters and determine risk factors.

2. The system must create an electronic file compatible with current CDC weekly reporting requirements.

   Measurement: A weekly reportable conditions file must be created and sent to the CDC with less than or equal to current staff time.

   Goal Attainment: CDC has validated the weekly file created by DREAMS and is able to merge the file with national data. This process requires no additional staff time.

3. To decrease the time between case reporting and investigation initiation the system will assign cases to the appropriate investigator.

   Measurement: The system must automatically and electronically assign cases to the proper field epidemiologist based on patient or facility address if patient address is unavailable.

   Goal Attainment: The system attempts to assign cases to the appropriate field epidemiologist without human intervention. The patient address is used first and if unavailable, the facility address is used. If neither are available, the case is assigned to the system administrator. The automatic case assignment eliminates the need for phone calls to assign and in some instances reassign cases. Therefore, investigations are able to start hours and in some cases days earlier.

4. The system will provide workload management tools for both investigation staff and supervisors.

Measurement: Policy must be developed along with the system to allow users to more adequately and efficiently manage their workload. In addition, supervisors must have the capability to track case investigation progress.

Goal Attainment: Case investigators are now able to prioritize cases, manage workload and conduct more complete follow up. The system's auditing capabilities allow supervisors to ensure that staff are completing investigations in a timely and appropriate manner.

5. Data must be received from a variety of sources to expedite case reporting.

   Measurement: Previously case and laboratory reports were sent through the mail to the department of health. This resulted in delays of days to weeks in reporting. The system must allow for near to real time reporting capabilities.

   Goal Attainment: The system is able to accept near to real time electronic laboratory reports from those facilities capable of sending such reports. This immediate reporting allows for investigations to begin within minutes to hours of the confirmation of a laboratory report. In addition, manual hand entry and daily electronic files are also accepted by the system.

6. The system must electronically identify duplicates and merge records.

   Measurement: Before DREAMS, all patient deduplication was a manual process. This must be electronic and automatic using an algorithm. In instances where the deduplication algorithm is unable to determine true duplications, the system must allow for human intervention.

   Goal Attainment: Using the Master Patient Index (MPI), DREAMS is able to pull out both duplicates cases as well as duplicate patients. The final decision whether or not to merge patients or cases is made by a system administrator.

COMMUNICATION

Throughout the project several communications channels were used. They were:

- Weekly conference calls: Weekly conference calls occurred at 1 PM (CST) on the last business day of each week, unless otherwise agreed upon by both project managers. Two days prior to the call, minutes from the last meeting were posted on the website and the agenda for the upcoming call was distributed to all attendees of the call. These calls were extremely important for all team members to be updated on progress. In addition, it was a weekly opportunity for developers to pose questions and gain additional information on requirements.
- Website posting project related items such as progress reports: This was a secure site requiring login by team members. It was hosted by the vendor. This communication method was not fully utilized. In the development of future modules, an issues tracking list should be posted and updated by both developers and the department of health team. This would provide both entities with a more complete and current picture of the project's status. It could also be used to track progress and ensure that requirements are not overlooked and lost.

- Onsite programmer: The vendor moved a programmer on site to work with the technical lead in all aspects of the project: Expenses incurred by the programmer were the vendor's obligation and not part of the agreed upon bid. Having a programmer on site was invaluable to the success of the project. The on site programmer was able to translate the day to day needs of the department to the rest of the development team. In addition, the on site programmer was able to provide valuable technical advice and expertise to address questions posed by public health partners, in particular private laboratories.
- Onsite visits: At agreed upon intervals, site visits were made by the project manager from the vendor. During these visits a compilation of incurred costs were presented. Additionally, scheduling and task completion was discussed to ensure the project was progressing as scheduled. This communication tool was the least effective of all utilized. These meetings could easily have been conducted via conference call and accomplished just as much. In the development of future modules, this communication method will not be used.

RISK MANAGEMENT

Risks in this project came from several areas. They were:

1. System Environment Compatibility
2. System Security
3. Laboratory Export Compatibility
4. Data Migration from NDIIS to the system
5. System Installation

System Environment Compatibility

Prior to sending out an RFP, several meetings with ITD occurred to examine the current environment and how to best build a system within the state's ITD environment. The recommendations from these meetings were used in developing part of the RFP. Additionally, upon receipt of different RFP's, ITD was brought into the selection conversations ensuring this compatibility existed with the vendor's proposal. Additionally, as the system is being developed, a VPN access for the vendor will be provided allowing access to the test environment.

There were a few delays with releases to account for ITD upgrades to ensure system compatibility. The vendor also tested the software in a somewhat different environment. As a result of issues seen with this, the vendor chose to replicate the North Dakota environment to ensure better testing.

System Security

In addition to the technology environment meetings with ITD, meetings with ITD and department of health security teams also occurred. Using their recommendations a security requirement was added into the RFP. The vendor's lead programmer met with ITD to ensure security policies were adhered to. Data security is handled through HL7 and ebXML. Both messaging tools are provided by the CDC.

Laboratory Compatibility

The main data sources for the surveillance system are the connections to the laboratories. These connections ideally would be done by a process of exporting LIMS data in HL7 ver 2.3.Z. However, many laboratories do not have this capability. Therefore, the vendor wrote a routine to convert files to proper format for all laboratory modules to ensure compatibility with the system and data security. Connecting laboratories required buy in from the laboratory management teams. At times this was difficult. While the laboratories acknowledged the benefit to electronic laboratory reporting, it has rarely been a priority to them.

Data Migration from NDIIS

To establish the main patient table, data from NDIIS was to be migrated in two different modes. The first was a complete data dump and the second was the delta dump. The first data dump occurred after the database has been cleaned of all possible duplicate information. This process took longer than originally anticipated. DREAMS went live before the original data dump was ready to be added. Therefore, the deduplication process within DREAMS also had to be run against the NDIIS data. The delta dumps are set to occur on a prescribed schedule. This data is sent via secure transport to update the main patient database.

System Installation

Throughout the installation process conference calls periodically occurred between ITD and the vendor along with department of health team members. This was necessary not only to ensure open communications, but also because the installation documentation provided by the vendor was consistently less than adequate. This posed problems for ITD staff. It was very important that ITD maintained the same staff assigned to the project from start to finish.

Data Mining and Usages

Data in the CDR will be accessible with Crystal Report Writer, SAS, as well as other tools. Data mining occurs primarily in the central office. However, NDDoH branch staff are also able to access the data. Confidential reports are planned to be published on a secure web page for usage at the local public health unit. Because these data analysis are high end, training was required for NDDoH staff to become proficient at their use.

MEASUREMENTS OF SUCCESS

The assessment demonstrated some weaknesses in the current business processes. Implementation of this surveillance system has done the following,

1. Shorten time from onset of disease to notification of the health department.
2. Implement tools to do data analysis of medical systems to identify outbreaks as they occur.
3. Implement management system to track activity of reportable cases.
4. Create map to display disease data for local or regional consumption.
5. Establish notification process to contact appropriate personnel based on threshold criteria.

Based on these main points, staff will have the ability to access data and track events as close to real-time as current business process allows.

Electronic Laboratory Reporting

Prior to the creation of DREAMS, disease reports from laboratory tests were called in to the staff of Disease Control, sent via paper copy or e-mail. Due to laboratory business processes, laboratory tests were validated (made official through internal laboratory processes) between 3:30 PM and 5:00 PM. The final data was not sent to Disease Control until the next business day at the earliest. The cases then had to be called to regional field epidemiologists for investigation and follow up. Not only was this process labor intensive, it greatly extended the time between diagnosis and possible interventions. This delay increased the risk of further transmission of the disease. In cases of highly infectious disease, the report was called to Disease Control staff to allow immediate investigation. In cases where the negative results were as important as positive results (used to determine the spread of outbreak), a review of previous testing had to be manually completed and sent as an additional submission.

With DREAMS, once tests are completed, the instrumentation completing the test electronically sends test results to a database. Based upon business rules agreed upon between the laboratory and Disease Control (current laboratory rules do not allow all negative test results to be shared, only when they are a part of a public health investigation), the test result is verified by the laboratorian and sent via HL7 to DREAMS. This process occurs throughout the work day, not at the end of the day which reduces reporting of all conditions by at least 12 hours. The electronic sending of data frees the laboratorian up to continue testing without having to manually aggregate data to be sent to Disease Control.

The use of Electronic Laboratory Reporting (ELR) makes the reporting of conditions automatic. Since the system was deployed, the system has caught several cases that were missed by manual submission. This process has begun being extended to private laboratories, increasing the accuracy of case reporting. Additionally, the aggregation of test results in a database allows the laboratory to send cumulative weekly reports to the Centers for Disease Control and Prevention (CDC). Previously, these reports were done manually through a parallel system requiring personnel to re-enter all data into the system.

Business Process Improvement

Prior to DREAMS, disease reports to Disease Control were based upon the reportable disease list. Reports were sent in by health care providers on a Disease Report Card or in the case of laboratories, a line list or laboratory report. In the case of some laboratories, positive test results and some negative results were manually aggregated and submitted either by phone, fax, mail or web based forms. Only once investigation into the conditions had begun were errors in data entry caught. This resulted in bench laboratorians returning to the previous business day's results and verifying results manually and calling the investigator back. The result was lost man hours and delayed investigations. If errors were found due to reporting, the investigator had to resort to the requesting facility where the patient was seen. This meant contacting the facility and manual checking of the data gathered. This left disease investigators subject to the availability of the facility staff to respond to the request. Additionally, because the process was a manual determination of which test results were to be shared with Disease Control, some test results were inadvertently not sent. Not until the ensuing investigation did the missing result appear (in the case of negative results) or in the case of positive results, when local health care providers received laboratory results and sent in their reports of positive

reportable conditions. If the disease report originated with the health care provider, the disease card was manually filled out and sent in. If errors or omissions occurred on the card, those errors were not caught again until the ensuing investigation was under way.

Because different entities were reporting (health care providers and laboratories), the data gathered by each entity often times did not coincide. The disease condition was the common thread and the disease investigator had to discern the correct data and update the case as the investigation developed. Simultaneous to the lack of commonality in disease reports, the sending of these reports were subject to human timing errors. Health care providers would send their disease reports via mail and as time allowed. This would lead to several days to a week delay due to the mode of transmission. Laboratory reports would then precede the disease card and the investigation would begin with partial demographic information. This resulted in disease reports arriving at disease control in different time intervals. Multiple disease reports could appear over the course of days to weeks, depending upon the party's submission.

Subsequent to deployment of DREAMS, disease reporting is done electronically. The demographics of the client are captured and stored in a Master Patient Index (MPI). Future references to this client refer to this database so demographics are available to both the laboratory and to Disease Control. During the course of the investigation, if there are changes in the demographics, the investigator updates the MPI and all future references to the client will reflect these changes. An allowance for multiple addresses (for example, in the case of college students living at home during the summer and on campus during school) and for an address history was built into the system. This sharing of data saves the laboratorians from having to manually call for additional demographic data as they now can reference the MPI.

With the demographics stored in the MPI, when test results are sent electronically to Disease Control, the case information is auto-populated. This eliminates the need for repeat calls to the laboratory or to the health care provider for this information. Additionally, with the test results sent electronically, the case investigation is begun electronically and stored in a work queue for investigators. Local health care providers can begin a case investigation electronically by logging into the system and opening a suspect condition. As soon as the case is submitted, it appears in an investigator's work queue. This reduces the time of reporting from days to a matter of minutes.

Altogether, the electronic sending of laboratory data and individual case submission will result in higher numbers of cases reported and reduce the time lapse in the reporting of cases. Consequently, with the common reporting area, Disease Control staff no longer have to look at multiple reports for a single case spread over several days. The common reporting allows for data aggregation and for multiple investigators to work on a single case reducing the amount of time needed to resolve cases.

Alerts

Certain disease conditions are deemed high priority due to the nature of the disease and infectious nature and/or severity of the disease. These category 1 diseases, when identified, will trigger higher rates of response because of this. Prior to DREAMS, if a provider suspected such a disease, or if the laboratory had a positive result of such a disease, a call to Disease Control staff occurred. If the call occurred outside normal business hours, the call was handled through the health department's case worker system where identified staff are electronically paged and would then begin proper notifications. Once notified, personnel would

have to follow up on the reason for the call. Therefore, they either called the source of the alert or came up to the health department to begin the follow up.

With DREAMS, the moment a category 1 disease hits the system, whether it is reported by a provider or if through Electronic Laboratory Reporting (ELR), a link to the Health Alert Network (HAN) is activated and specified groups of individuals are notified. The individuals in the groups have the ability to control how they will be individually notified by specifying cell phone, office phone, home phone, pager, email and so on. The entire group will receive the alert and can log into the system from their homes and see the reason for the alert. This shortens the time for actual investigation into the alert.

Additionally, users within the system and can set up alerts relevant to their job function based upon case counts. For example, persons working with vaccine preventable diseases, i.e. pertussis (whooping cough) could set up an alert based upon the number of pertussis cases appearing over a certain period of time and/or within a certain geographic region. The ability to be alerted on case counts allows staff to look at potential outbreak situations. A retrospective review of data indicates that a food borne outbreak would have been detected in this way, had the system been operational at the time.

Case Management

As more and more emerging infectious diseases are identified and become reportable, the work load for field epidemiologists and others doing case investigation work increases. With this constant increase, it has become necessary to provide a case management tool to assist in tracking cases and investigations. The DREAMS system does this. With DREAMS, case investigators and supervisors are able to document and follow case and investigation statuses.

Previous surveillance systems have not provided adequate case follow-up tools. For most conditions, only core demographic data was collected by electronic systems. Additional risk exposure and/or additional contact information may have been collected on paper, but was not electronically recorded. Therefore, it was very difficult to conduct analysis that might identify links between cases and document possible exposures. DREAMS allows the data regarding a case to be stored electronically with the case. This data can then be retrieved at a later date if necessary and further analyzed. In addition, all cases regarding a single outbreak can be linked together.

Reporting and Data Quality

A main component of any disease surveillance system is reporting. Historically, weekly reports were sent to the CDC using the National Electronic Telecommunications System for Surveillance (NETSS). DREAMS is capable of creating a valid report message in the NETSS format. This provides a mechanism for weekly reporting to the CDC without additional data entry or data formatting.

Accurate data is a necessity for data analysis. Surveillance systems prior to DREAMS have had extremely limited, if any quality assurance capabilities. The bulk of case and patient de-duplication was a manual process. This process was both labor and time intensive. In addition, there was still a problem with human error. The DREAMS system is designed to help alleviate these issues. Using a predetermined algorithm, the

system searches for possible duplicate patients and cases. A system administrator is then able to determine if the matching data are a true duplicate or not.

Another essential component of reporting is data analysis. The increased electronic storing of data allows for much greater data analysis capabilities. The implementation of data mining tools such as Crystal Reports and SAS ease and streamline this process. The system also has the capabilities for geospatial data analysis. However, this module has not yet been turned on.

LESSONS LEARNED

Business Analyst Use Needed

From the first day the team in Disease Control met to discuss requirements and creation of the system, a common vision existed. Because of the business processes familiar to all on the team, the final product had all the components dealt with on a day to day basis. When the vendor was accepted and the initial requirements document was created, the requirements were based upon the vendor's product and the vendor's model of how public health was exercised. This model was built on another state, not North Dakota. Even though the terminology was the same, the processes were not. Because the terminology was the same, when discussions on topics moved forward, both parties maintained their visions without realizing the views were not one and the same. As the development proceeded, the two models existed in the vendor and client minds. Subsequently, as the development demonstration of the product was deployed, the differences in the views became apparent resulting in changes to the development. These changes resulted in production delays and in some cases, the addition of functionality to meet the client's needs.

If a business analyst had been brought in from the onset, several tools could have been used to avoid this situation. A validation of the requirements could have been completed. This would have taken all the business processes used in Disease Control and matched to the capabilities of the system. Developers would have had a better idea of how the business processes flowed and the creation of the product would have reflected those processes from the onset. Additionally, a crosswalk of the system capabilities could have been matched to the processes used by Disease Control. The crosswalk would have forced a formalization of the business processes used. In addition, it would have forced Disease Control to evaluate all their processes and see if changes were needed. Because the system had new functionality and would expedite some of the processes, business rules needed to be modified. One example of this was in the case of alerting. With the system having the capability to alert staff, the whole alerting process had to be re-analyzed.

Change Control Board Created and Exercised

As the project went forward, attempts to narrow the gap between the North Dakota vision and the STC vision occurred. Along with these attempts, Disease Control staff were exposed to ideas to enhance the developing system. These ideas were brought forth in the weekly meetings and a case was made to have them included in the project. The combination of vision adjustments and new enhancements were brought into the project by the STC project manager. Often times this occurred without any analysis of the impact to the overall project. As with the initial statement of work and requirement list, use case analysis was not done on the new enhancements.

This process of project adjustment without definition caused the project planners to lose focus of critical issues. The lack of analysis of project enhancements and adjustments resulted in missed milestones and elongated timelines. To address these issues, a change control board made up of members of both teams should have been formed. The board would have addressed these items on a case by case basis and addressed the impacts of the changes prior to development and implementation. It also could have addressed the enhancements and use cases of the enhancements The analysis done by this board could then have been used to assess and balance the value of the against the overall project plan.

Qualifications of Key Personnel

When North Dakota created the request for proposal, one of the requirements was a section requesting the resumes of people who would make up the team. Prior to the selection of vendor, little time was spent on evaluating these qualifications. During the course of the project, this oversight quickly became apparent. The project manager from the vendor, while having spent a length of time within a health department, did not have experience working with public health issues. Additionally, some of the members of the project team did not have any public health background. This resulted in a lack of understanding of processes which impacted the overall project. On North Dakota's side, key personnel had ample experience in public health but not in software development. A lack of understanding of the development process resulted in somewhat unrealistic expectations of the vendor.

Prior to awarding the contract, two tasks should have been completed. A more thorough analysis of key players from the vendor should have been added to the process. While validation from the vendor could still have been just words, this would have given more information to the make up of the vendor team. Second, even though it seemed like more overhead at the time, meetings with an outside agency such as ITD would be beneficial to get a second view of the projects and associated plans. This would perform a validation on the side of the state that would ensure all the appropriate actions and considerations have been taken into account, not just from the view of the project itself but also the processes associated with that project.

Milestones and Critical Systems

When the project kick off occurred, a general agreement of the timelines were understood by both the vendor and the state. However, no identifiable milestones were articulated and tracked to achieve those timelines. A general state of progress was not known as the project went forward. Not until the project reached a point just prior to the first install was it known by all that the initial deployment date would not be met. If key milestones had been put in place, this would not have occurred. Problem areas would have identified and addressed before those problems had a major impact on the overall project.

Additionally, key ancillary data systems such as the connections to the laboratories should have been identified at the beginning of the project and processed in parallel to the system development. As the system matured, it surfaced quickly that these ancillary systems were critical data streams that were not ready. As a result, connections to the systems were completed rapidly and their full testing and impact were not completed until several iterations were deployed. A thorough analysis of the entire system would have caused this to surface.

Testing and Production Environment Compatibility

A part of the RFP included the state's current technological environment. Great care as to the accuracy of this environment was given. This included several meetings with key ITD personnel to discuss the nature of the project and the impact on the current technological environment. When the vendor responded to the RFP, this environment should have been recreated to some extent in the vendor's test area. Several releases and installations came that did not function appropriately without extensive work on the part of ITD personnel. This could have been avoided if the two environments were more similar so alpha and beta testing would have occurred on similar systems.

Payment Schedule to Support Milestones

In the contract negotiations, a payment schedule was outlined with upfront money for development and hardware, additional payment after the installation and final payment after product acceptance. While this seemed adequate at the time, it would have been more appropriate to have payments which would coincide with milestones of the project. The increased number of payments would serve to cash flow the project better on the vendor's side and would serve to protect the state's interests. If milestones were not achieved and signed off on, the payment or a percentage of the payment could be withheld as incentive to keep the project moving forward.

Project Schedule and Development

Soon after the kick off, the vendor made a prototype available for evaluation. The Department of Health assembled a team to evaluate this prototype as well as to validate current business processes. The team quickly lost its focus on business processes and focused on the appearances of the screens. The developers, to accommodate these requests, spent development time on these changes instead of driving forward on the functionality of the system. The result was lost time on superficial issues such as appearance that should have been addressed at the end of the development cycle, rather than system critical issues.

Additionally, as the project went into development, business constraints on the part of North Dakota pushed the project timeline ahead of development capabilities. To appease these requirements, the vendor attempted to meet the adjusted timelines but this created a false impression to the client. The timelines could not be kept but the expectations of the state were of the new timelines. This created an artificial sense of urgency.

Actions Beneficial to the Project

From the moment the project began, the vendor did everything it could to meet the demands of North Dakota. Whether the demands were within the scope of the project or not, the vendor accepted the demands as part of the requirements and drove on with the project. This acceptance went a long way in keeping the working environment between the state and the vendor very positive. Examples of such activities included the purchase of needed hardware and software ancillary to the project, putting a developer in North Dakota for three months early in the project and arranging training on elements of the project.

It cannot be understated the value of having a developer located in the state. His actions pre-empted many items that may have been left for weekly meetings which could have developed into bigger issues. He still is

involved with maintenance of the product and his first hand knowledge has been invaluable in resolving issues.

ITD Project and Product Support

The actions of ITD cannot be understated for this project. Personnel from ITD were involved with and necessary for every aspect of the project from hardware requirements to GIS integration to system administration and implementation. The vendor was forced to work closely with ITD. ITD was able to provide the vendor with detailed information regarding the operating environment in North Dakota. With each new release of the product, the vendor provided instructions for installation and configuration. These instructions were not as detailed as they should have been. As a result, ITD personnel often had to make modifications to the system on the fly for the system to be functional.

As problems arose, ITD personnel were regularly tasked with sending log files to the vendor, often multiple times a week. ITD personnel also participated in multiple conference calls and meetings to resolve issues, and provided technical assistance for future development and implementation with other projects.

ITD operates DREAMS in two parallel systems, one production and one test. This was important, particularly as new releases were becoming available. The new releases were installed in the test environment first so that system stability could be evaluated. The Disease Control system administrator could also evaluate the new release in a production like environment to resolve any major issues before the new release was put in production for users.

KEY PROJECT METRICS

Key Project Metric: Cost

The initial budget for the project was $2,056,900. However, during the course of the project, some of the additional surveillance modules were scaled back because of partner limitations with staffing and time allocation. The final cost of the project was $851,040. This is below the original estimation for the project. The remaining funds were redirected to other grant activities outside the division.

Key Project Metric: Schedule

The original schedule called for completion by August 31, 2005. The department of health signed off on the acceptance letter for the project June 14, 2005.

Key Project Metric: Scope

Post implementation, five change requests were submitted and completed by the vendor. All requirements were met with the exception of three which are in the process of being activated.

Key Project Metric: Quality

During the user acceptance testing, fifty-five help desk items were submitted to the vendor for modification, increased functionality or bug fixing. Those items have been resolved.

PROJECT CONCLUSION & FUTURE ENHANCEMENTS

The development of DREAMS was a major undertaking both in respects to monetary resources and personnel time for several entities. Historically projects such as this on the federal level have taken many years longer to complete than originally anticipated, resulting in greater expense, greater requirements, a loss of ownership among participants and reduced acceptance support from stakeholders. It also resulted in a loss of focus and projects were forced to be scaled back, re-evaluated and then moved forward. These issues were very much a concern to both the vendor and Disease Control and were kept in mind during the product development. As a result, the DREAMS project was completed on time and under budget.

The resulting product, DREAMS, was developed with many specialized features for North Dakota. However, it also encompassed the requirements of the CDC while staying within the allotted cost and on schedule. The vendor has also developed and continues to develop similar systems for several other states. Because future enhancements and developments would benefit all states, the vendor has been willing to work with a cooperative group of states. These states are able to develop a common set of requirements. The resulting development and production costs of these requirements are then shared by a group. Examples of this are the STD Program Area Module and an Outbreak Management System. In addition, enhanced or improved functionality requested by one state may be given to all interested states under future maintenance agreements.

DREAMS is also the first step towards interoperability between programs. Rather than each program having silo surveillance applications which require duplicated efforts by personnel, DREAMS incorporates all programs into one surveillance system. Therefore, there are greater opportunities for effective data sharing while maintaining and controlling security and patient confidentiality at all times.

Appendix A

Acronyms Used in this Document
In Order of Appearance in the Document

DREAMS – Disease Reporting Epidemiological Assessment and Monitoring System

CDC – Centers for Disease Control and Prevention

NEDSS – National Electronic Disease Surveillance System

IT – Information Technology

HIPAA – Health Information Portability and Accountability Act

IDR - Integrated Data Repository

HAN – Health Alert Network

BT – Bioterrorism

LDM – Logical Data Module

CDR – Communicable Disease Reporting

EMS – Emergency Medical Services

HL7 – Health Language seven

NDIIS – North Dakota Immunization Information System

RFP – Request for Proposal

VPN – Virtual Private Network

ebXML – Network messaging system

LIMS – Laboratory Information Management System

ESRI – Environmental Systems Research Institute (Geographical Information System technology software vendor)

ND GIS Hub – North Dakota Geographic Information System Hub

ELR – Electronic Laboratory Reporting

MPI – Master Patient Index

STD – Sexually Transmitted Disease